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**A FAST DETONATOR-ACTIVATED BALL SHUTTER
FOR HIGH EXPLOSIVE EXPERIMENTS**

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A FAST DETONATOR-ACTIVATED BALL SHUTTER
FOR HIGH EXPLOSIVE EXPERIMENTS*

Roy A. McWilliams and William G. Von Holle

ABSTRACT

A detonator-activated ball shutter has been developed to protect the quartz windows in a 10 gm shot chamber used for optical-laser experiments on detonating high explosives.

INTRODUCTION

The overall objective of the study from which the need for this explosive device arose is the determination of the Raman spectra of a detonating explosive. This requires pulsed laser beam access to the explosive through polished fused silica windows. However, as a result of the detonation, unprotected windows are damaged by shrapnel from the explosive assembly rendering them useless for further tests.

It became necessary to design and test a new type of high speed shutter to protect the quartz windows.

EXPERIMENT DESIGN

Two fast ball shutters protect the quartz pressure windows as follows: An SE-12 detonator, contained in the chamber barrel propels a steel projectile which, in turn, moves a lever connected by a shaft to a 1-1/4 inch diameter ball that has an 11/16 diameter hole through its center as in Figure 1. This allows a pulsed laser beam to pass through unobstructed. SE-12 detonators in the gun barrels were fired 951.4 μ s before the laser pulse and 2.5 ms before the 10 gram PETN main charge was fired since movement begins only after this delay. The timing sequence is shown in Figure 2. We require that the laser pulses must be allowed to pass; then this path is closed off to fragments, thus protecting the optical windows.

The fast double-acting ball shutter was tested under experimental conditions in the 10 gm chamber by passing a 1mW He/Ne cw laser through the system and detecting the beam interruption caused by the closing shutters with a fast PIN diode circuit as in Figure 3. About 300 μ s is required to completely close off the 11/16 diameter aperture of the ball shutter after movement begins. In a further test, laser interrogating pulses passed through as the detonators fired and the windows remained unharmed for a SE-12 detonator fired near the center of the chamber.

The det chambers and projectile are cleaned and reused again.

CONCLUSIONS

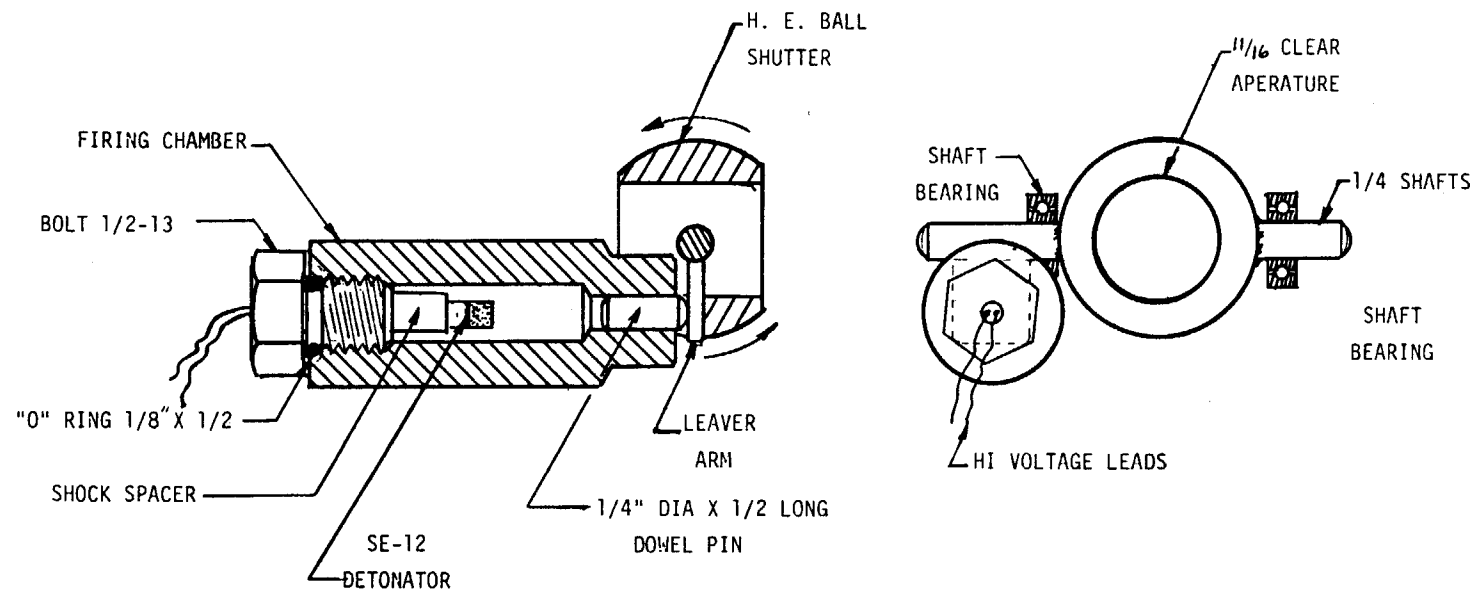
The ball shutters will protect optical windows from damage enabling optical access to small amounts of violently reacting or detonating materials.

7
1

2
2



BALL SHUTTER SCHEMATIC



SCALE 1"

FIGURE 1



HIGH EXPLOSIVE BALL SHUTTER

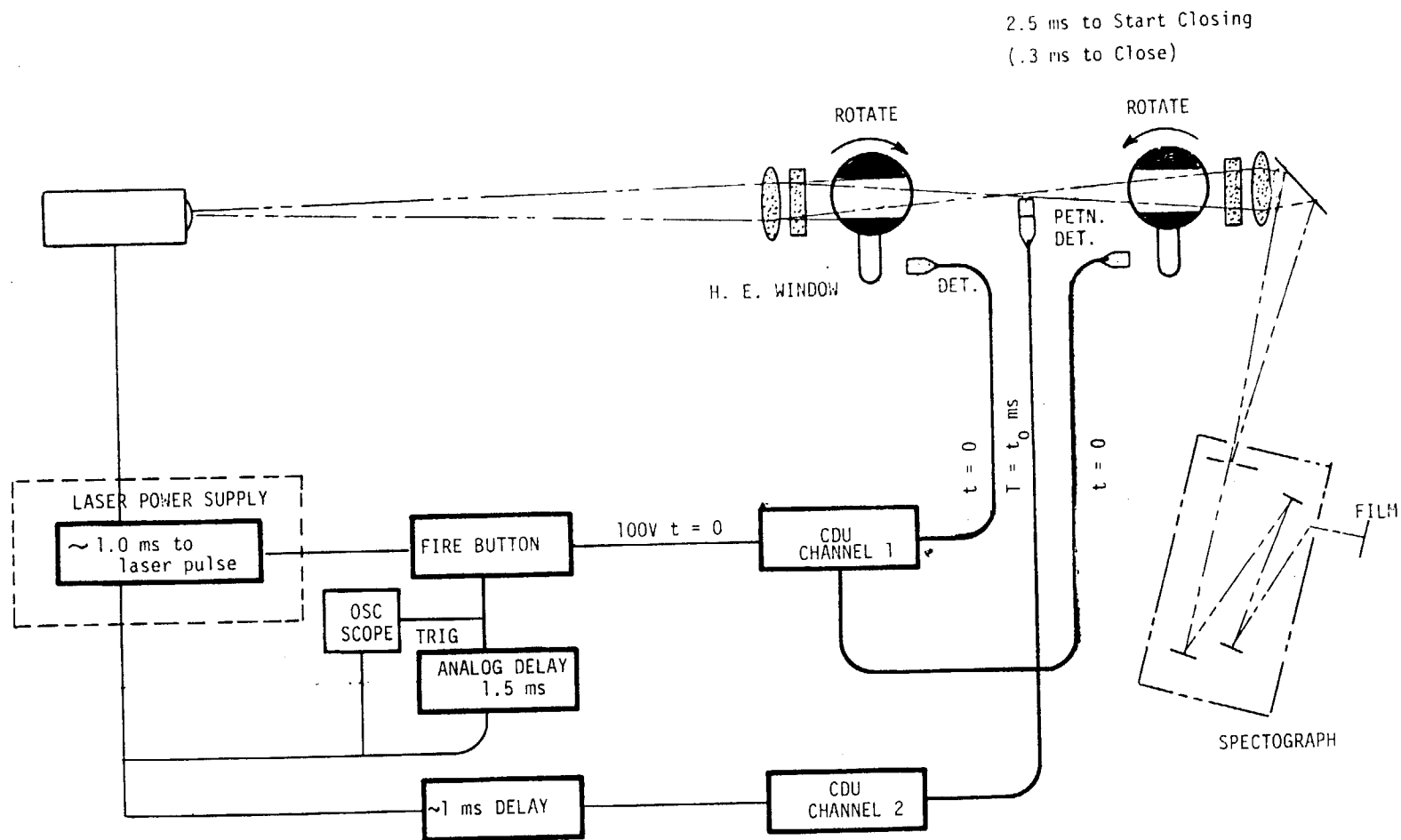


FIGURE 2



TIMING CIRCUIT BALL SHUTTER

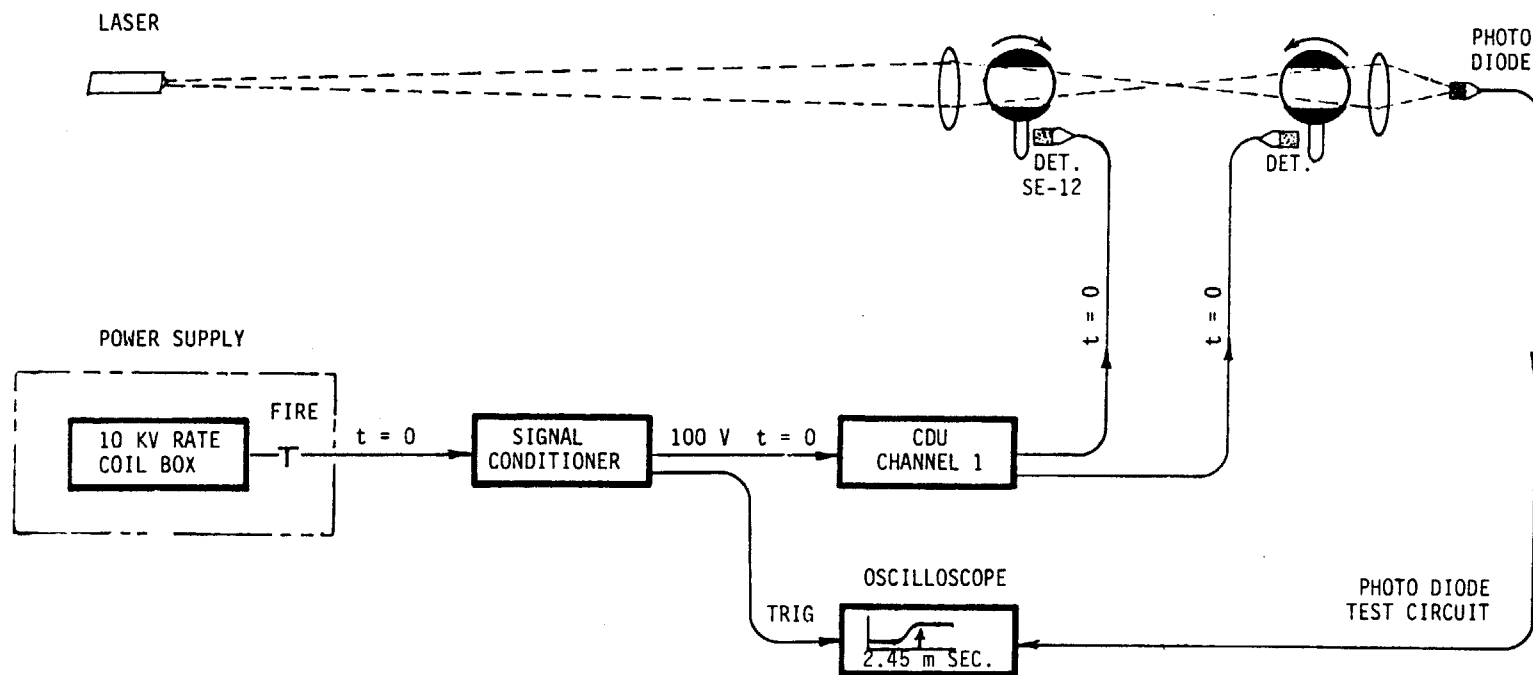


FIGURE 3

